

SECTION 15885

HEPA FILTRATION SYSTEM

Edit specification to suit project. Refer to the superscript notes on the last page. Consult with FSS-21 for fire protection requirements. For additional criteria on filter train arrangements, refer to the mechanical Standard Dwgs, ST6700.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fire Screens
- B. Prefilters
- C. HEPA Filters (GFE)
- D. Chemical Adsorbers
- E. Filter Train

1.2 LANL FURNISHED AND INSTALLED EQUIPMENT

- A. High efficiency particulate air (HEPA) filters.

1.3 SUBMITTALS

- A. Submit the following in accordance with the requirements of Section 01300:
 - 1. Filters (fire screens, prefilters, chemical adsorbers)⁽¹⁾.
 - a. Catalog data indicating the filter efficiency and pressure drop at rated capacity.
 - b. Installation instructions.
 - 2. Filter Train
 - a. Catalog data.
 - b. Certifications that unit meets ASME N509-1989, and ASME N510-1989 requirements.
 - c. Installation instructions.
 - d. Materials/part lists.
 - e. Shop drawings.
 - f. Test report of pressure decay leak test for the entire housing and each sub assembly.
 - g. Warranties.

1.4 MAINTENANCE

- A. Extra Materials: Furnish temporary prefilters to be used during construction.

PART 2 PRODUCTS

2.1 Fire Screen

- A. Manufacturer: Farr Co., Type 44G
- B. Frame size 23 3/8 in. x 23 3/8 in. x 2 in., no gasket, all metal filter with zinc plated steel screen media, initial pressure drop 0.06 in. w.c. at 1000 cfm. Filter not to be oiled.

2.2 Prefilter

- A. Manufacturer: Farr Co., RIGA-FLO 15
- B. Frame size 23 3/8 in. x 23 3/8 in. x 5 7/8 in., no gasket, UL Class 1, 65% efficiency per ASHRAE Standard 52-76, initial pressure drop 0.20 in. w.c. at 1000 cfm.

2.3 HEPA Filter (LANL FURNISHED AND INSTALLED)

- A. Frame nominal size 24 in. x 24 in. x 12 in., nuclear grade, gasket seal, UL Class 1, 99.97% efficient, initial pressure drop 1.0 in. w.c. at [1000 cfm, LANL Stock No. GS2724] or [1250 cfm, LANL Stock No. GS2741]⁽¹⁾, fire-retardant wood frame or stainless steel frame material, and guaranteed to operate up to 10 in. w.c. without failure.

2.4 CHEMICAL ADSORBER

The following is a sample specification of a chemical adsorber. Consult with ESH-5 and the user for specific criteria.

- A. Manufacturer
 - 1. Charcoal Service Corporation, Part No. CSC-18-62-AS
 - 2. Flanders Filters Inc., Part No. 2V-C63-G18
- B. Type I (V-Bed) adsorber with 2 in. thick bed of 8 x 16 mesh activated carbon made from coconut shell. Residence time 0.125 seconds at a flow of 1250 cfm. Construct adsorber frame of 14 gage. 304 stainless steel with 26 gage 304 stainless steel perforated screens. Provide adsorber frame with 1/4 in. thick x 3/4 in. wide closed cell neoprene gasket on the upstream flange. Adsorber shall meet the requirements of ASME N509-1989 and shall be factory tested in accordance with IES-RP-CC-008 (latest edition) to verify a minimum mechanical efficiency of 99.9%. Adsorber nominal dimensions are 24 in. x 24 in. x 18 in..

2.5 FILTER TRAIN

- A. Manufacturers
 - 1. Flanders, E6 housing, gasket seal.
 - 2. Charcoal Services Corp.
 - 3. AAF/Snyder General, 6119 Series.

B. Filter Train Assembly

Arrangement: Provide a [] high x [] wide filter train assembly with side access doors on [the left or right or both sides]⁽¹⁾⁽²⁾ looking in direction of air flow, transitions on both ends, and with housings assembled in direction of air flow as follows; [2 in. fire screen, 6 in. prefilter, test section, 12 in. HEPA filter, test section, 18 in. chemical adsorber, test section, 18 in. chemical adsorber, test section, 12 in. HEPA filter, and test section.]⁽¹⁾ The filter train assembly shall be built up of factory leak tested subsection housings that are no larger than 1 high x 3 wide. Join housings together vertically, in parallel and/or in series to make up a filter train. Weld joints airtight and conform to standard welding procedures.

C. Containment Housing [(for HEPA filters, prefilters, adsorbers and fire screens)]⁽¹⁾

1. Construction: Construct housing from [Type 304 and 304L]⁽⁴⁾ stainless steel with a 2B mill finish. Provide housing with 100% seam-welds in accordance with ASME N509-89, paragraph 7.3 on joints across the pressure boundaries and reinforce to withstand up to [10 in.]⁽⁶⁾ w.g. [positive]⁽¹⁾⁽³⁾ or [negative]⁽¹⁾⁽³⁾ pressure. Wire brush and clean welds to remove discoloration and weld splatter. Joints and seams which are part of the filter sealing surface, flange connections and bag-out rings shall be ground smooth and free of burrs and sharp edges. Factory weld housings, transitions, base, lifting lugs, and weather cap to form one unit. [Weld a sampling port, 3/4 in. Schedule 40 pipe, to the top of the HEPA housing, upstream of the filter.]⁽⁵⁾ Provide type 300 series stainless steel miscellaneous mechanical components. Manufacture housings in accordance with ASME N509-89-Nuclear Power Plant Air-Cleaning Units and Components.
2. Access Doors: Provide removable, separate, access doors for each tier of filters [(HEPA filters, prefilters, adsorbers, and fire screen)]⁽¹⁾. Use solid silicone or neoprene gaskets that seal the door to the housing wall while maintaining clearance between the bag-out flange and the inside door surface. Door gasket shall be a molded gasket fitted to the door. Use door gasket material of extra firm (21-29 PSI by compression/deflection) density closed cell silicone sponge conforming to MIL-R-46089 with skin surface finish or ASTM D1056 grade SCE-45 or 30-40 Shore-A-durometer neoprene. Provide stainless steel door latches that pivot away after release and remain attached to the housing or door. Use 300 series s.s. bolts with nuts made from a precipitation hardening (PPH) grade of stainless steel, treated substantially harder than the bolt. Metal pockets for instruction manuals are optional.
3. Smooth Inlet Design: On the upstream side of each prefilter and filter position, provide a smooth inlet design with a minimum 3/4 in. deep recess around the upstream perimeter of the prefilter or filter to limit the buildup of contaminants in crevices or filter frames.
4. Filter Locking Mechanism: Provide a filter locking mechanism with a replaceable locking tray in the HEPA housing [and chemical adsorber housing]⁽¹⁾ having a total clamping load of about 1400 lbs. per 24 in. by 24 in. HEPA filter (per ERDA 76-21 4.3.4).
5. Filter Rails: Provide filter rails in the [fire screen and]⁽¹⁾ prefilter housings, [2 1/8 in. wide for the fire screen]⁽¹⁾ and 6 in. wide for the prefilter.
6. Filter Removal Rod: Provide housings with two or more filters per access door with a replaceable removal rod to draw the filters to the change out position.
7. Bag In/Out: Provide each filter access door with a bag-out port inside the access door which is hemmed on its outer edges to prevent tearing of the bag. Provide two continuous ribs on the outside of the port to hold the bag's elastic shock cord and the safety strap during the bag-out operation. The turned edge on the port is not considered a rib. Provide each housing with two, 8 mil, transparent PVC glove bags for each bag-out port. Incorporate mittens into the bag. Provide bag with stock number rolled into the hem for easy identification when reordering. Provide bag with a smooth finish to prevent from sticking to itself and provide a nylon safety strap with each bag-out port to prevent

the bag from slipping off during the bag-out procedure. Provide a cinching strap with each bag-out port to tie off the slack in the bag while the exhaust system is operating. Provide a banding kit to facilitate in the secure clamping off of the bag between the housing and the spent filter.

8. Filter Removal Tray: Provide one filter removal tray for each size of HEPA filter [and chemical adsorber]⁽¹⁾ to aid in the change-out operation.

D. Test Sections:

1. Construct test section in such a manner that adjoining test chambers are isolated from each other to permit individual testing of each HEPA filter [and chemical adsorber]⁽¹⁾ and its pressure boundary for its efficiency per ASME-N510-1989.
2. Provide test section with separate aerosol mixing devices, sample ports, and inlet ports to allow individual in-place testing of the HEPA filters [and chemical adsorbers]⁽¹⁾ per ASME N510-89. Upstream sampling sections, and downstream sampling sections that require the use of external power, e.g., compressed air, are not acceptable. The pressure drop through each test section during testing and normal operation is not to exceed 0.25 in. w.g. at 1000 cfm per filter. Provide 2 in. Schedule 40 injection ports and 1/2 in. Schedule 40 sampling ports. Identify each test section with a model number and label all test equipment such as operational handles, injection and sample ports. Provide a DOP injection manifold and a sampling manifold on a multiple high or wide filter train. Manifold all test sections per stage together in order that each stage of HEPA filter [and chemical adsorber]⁽¹⁾ can be treated as a single unit. Provide a stainless steel manifold that has valves located to isolate individual HEPA filters and [chemical adsorbers]⁽¹⁾ in the event the system fails the in-place LANL testing criteria at the job site. Provide one external connection for each manifold and locate 30 in. - 60 in. above the filter train base. Ship the manifold loose for installation by others. Provide a union at each break point. Position each manifold to allow for the change out of all filters without causing interference.
 - a. DOP Injection Manifold: Construct the manifold of 1 in. Schedule 40 pipe or 3/4 in. OD tubing and provide a full port ball valve, 1 in. male NPT end, at the inlet port of the manifold.
 - b. Sampling Manifold: Construct the manifold of 1/2 in. Schedule 40 pipe or 5/8 in. OD tubing and provide a full port ball valve, 1/2 in. male NPT end, at the outlet port of the manifold. Install ball valves on each manifold branch line to allow each HEPA filter [and chemical adsorber]⁽¹⁾ to be individually tested.

E. Pressure Decay Leak Test:

1. Factory leak test each subsection housing and the completed filter train assembly by the pressure decay method to [plus 10 in. w.g.]⁽⁸⁾ [minus 10 in. w.g.]⁽⁸⁾ in accordance with ASME N510-89-Testing of Nuclear Air Cleaning Systems. Leak test to acceptance criteria of a maximum of 0.2 percent of housing volume per hour at [design pressure]⁽⁸⁾. Rectify and retest any deficiency and work effected by such deficiency. Submit certifications of leak test.

F. Miscellaneous

1. Static-Pressure Ports: Locate static-pressure ports on the front or top of the housing upstream and downstream of each filter bank. Provide 1/4 in. NPT ports with cap, type 304 stainless steel.
2. Base: Provide a 6 in. high stainless steel channel base on four sides welded to the unit and with predrilled mounting holes.

3. Quality Assurance: Comply with ANSI/ASME NQA-1.
4. Lifting Lugs: Provide type 304 stainless steel lifting lugs with a 2 in. diameter lifting eye.
5. Custom-Engraved Plates: Include plates with the housing model number, and the original order number with minimum 1/8 in. letter height. Fabricate custom-engraved plates from polished stainless steel and permanently weld to the housing.
6. Seismic Qualification: [Consult with ESH personnel and the design team structural engineer for the specific project requirements that will govern the seismic criteria to be used.]
7. Weather/Housekeeping Cap: Provide a continuously welded weather cap to the top of each housing and sloped to prevent accumulation of liquids.
8. Transition to Ductwork: Provide [24 or 36 in. long]⁽¹⁾⁽⁶⁾ inlet and outlet transitions welded or bolted to the housing with a 2 in. x 2 in. x 3/16 in. minimum x [] I.D.⁽⁷⁾ angle ring flange with predrilled mounting holes and shipped with gaskets. If the transition is bolted, the spacing shall be the manufacturer's standard bolt-hole pattern, not to exceed 4 in. between bolt holes on center. Transition to be capable of withstanding up to [10 in. w.g. negative or positive]⁽¹⁾ pressure. Provide gasket materials of closed cell neoprene, 1/4 in. thick, ASTM D1056 Specification for Flexible Cellular Materials - Sponge or Expanded Rubber, Grade SCE-45 or 30-40 Shore-A-durometer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Field Conditions: Examine areas and conditions under which air filters and filter housings will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION

- A. Filter Train: Install per manufacturer's instructions. Secure filter train to concrete pad with concrete anchors. Drill to match holes in base.
- B. Filters: Install in accordance with manufacturer's instructions and recognized industry practices. LANL will furnish, test, and install HEPA filters.
- C. Fan Operation: Do not operate fan system until filters are in place. Replace temporary filters used during construction.

END OF SECTION

***** Superscript Notes

- (1) Edit to suit job requirements.
- (2) Specify doors on both sides when there are more than 3 filters wide in a bank.
- (3) Consult with the manufacturer if a higher pressure system (greater than ± 10 in. w.g.) is required (additional bracing may be necessary).
- (4) Specify 316/316L material for high corrosive air stream.

- (5) Provide an upstream sampling port with the filter housing only when the train assembly consists of a 1 high x 1 wide HEPA filter and a test inlet section is not provided.
- (6) Specify 36 in. long transitions for 3 high x 3 wide assemblies and 24 in. long transition for assemblies less than 3 high x 3 wide.
- (7) Edit to suit when upstream or downstream duct sizes are different or if rectangular duct is used.
- (8) Edit operation pressure to suit. The plenum must be tested at the maximum pressure it could possibly see during service. A housing that is normally under a negative pressure but could see a positive pressure during an upset condition, e.g., fan failure, must be tested for both a positive and a negative pressure of the expected magnitude. As a minimum, use a test pressure of ± 10 in. w.g.
